

CM We claim:

1. A polyaxial screw and coupling element assembly for use with orthopedic rod implantation apparatus, comprising:

a screw having a semi-spherical head;

5 a cylindrical body including an axial bore defining a bottom chamber portion at a bottom end thereof and a rod receiving channel at a top end thereof, said bottom chamber portion further defining a tapered lower portion and a constant diameter upper chamber portion, and said top end having a threading thereon;

a two-piece interlocking coupling element including

10 a socket portion having a semi-spherical interior volume for receiving therein the head of said screw, upper and lower sections, and vertical slots formed in said upper and lower sections, at least one of said slots rendering said interior volume expandable and contractable, said lower section having a tapered exterior surface for nesting in said tapered lower chamber portion of said cylindrical body such that forceable advancement of socket portion along the tapered lower chamber portion of the axial bore causes the at least one of said slots to narrow such that the semi-spherical interior volume contract, and

15 a cap portion having an opening in a bottom thereof and an interior chamber extending upwardly therefrom for joining with, and slideably retaining therein, the upper section of said socket portion, said cap portion initially seating with a portion thereof extending into a bottom portion of said rod receiving channel; and

20 a top locking nut, mateable with said threading, for locking a rod in said channel and for applying therethrough a downward force onto said cap portion,

wherein said semi-spherical head portion is rotationally freely mounted within the semi-spherical interior volume of the socket portion prior to said socket portion being forceably advanced into the tapered lower chamber portion of the axial bore, and

5 whereby downward compression of a rod in said channel portion of said body member, by said top locking nut, onto the cap portion causes the forceable advancement of the socket portion into the tapered lower chamber portion of the axial bore, and locks the screw, coupling element and body relative to one another.

10 2. The polyaxial screw as set forth in claim 1, wherein said semi-spherical head of said screw further includes a recess formed therein for receiving therein a screwdriving tool such that said screw may be threadably advanced into a vertebral bone.

15 3. The polyaxial screw as set forth in claim 1, wherein said threading on said top end is on the interior surface of said channel.

4. The polyaxial screw as set forth in claim 3, wherein said cap portion further includes a threading and wherein said cap portion needs to be threadably advanced along the threading to be seated in the bore into its initial position.

20 5. The assembly as set forth in claim 1,
wherein said socket portion further comprises a substantially constant diameter upper section having an outwardly annular extending lip at an extreme end thereof,

wherein said opening in the bottom of the cap portion comprises an inwardly directed annular lip, and

wherein at least one of said vertical slots in the upper section of said socket portion renders the upper section thereof to be expandable and contractable such that the upper section of
5 the socket portion may be forceably inserted into the opening in the bottom of the cap portion so that it may be retained in the interior chamber therein by mutual interference engagement of the inwardly directed annular lip of the cap portion and the outwardly extending annular lip of the socket portion.

6. The assembly as set forth in claim 5, wherein the interior chamber of the cap portion comprises a tapered surface such that advancement thereof into the hole causes an inwardly directed force against the upper section of the socket portion, therein causing the at least one of said vertical slots in the upper section to narrow and causes the upper section to contract and further lock the head of the screw within the interior semi-spherical volume of the socket portion.

7. An orthopaedic implant apparatus having a rod and a plurality of screw and coupling element assemblies, comprising:

at least one screw having a semi-spherical head;

20 at least one cylindrical body including an axial bore defining a bottom chamber portion at a bottom end thereof and a rod receiving channel at a top end thereof, said bottom chamber portion further defining a tapered lower portion and a constant diameter upper chamber portion, and said top end having a threading thereon;

at least one corresponding two-piece interlocking coupling element including

a socket portion having a semi-spherical interior volume for receiving therein the head of said corresponding screw, upper and lower sections, and vertical slots formed in said upper and lower sections, at least one of said slots rendering said interior volume expandable and contractable, said lower section having a tapered exterior surface for nesting in said corresponding 5 tapered lower chamber portion of said cylindrical body such that forceable advancement of socket portion along the tapered lower chamber portion of the axial bore causes the at least one of said slots to narrow such that the semi-spherical interior volume contract, and

10 a cap portion having an opening in a bottom thereof and an interior chamber extending upwardly therefrom for joining with, and slideably retaining therein, the upper section of said socket portion, said cap portion initially seating with a portion thereof extending into a bottom portion of said rod receiving channel; and

15 at least one corresponding top locking nut, mateable with said threading, for locking a rod in said channel and for applying therethrough a downward force onto said cap portion,

20 wherein said semi-spherical head portion is rotationally freely mounted within the semi-spherical interior volume of the socket portion prior to said socket portion being forceably advanced into the tapered lower chamber portion of the axial bore, and

25 whereby downward compression of a rod in said channel portion of said body member, by said top locking nut, onto the cap portion causes the forceable advancement of the socket portion into the tapered lower chamber portion of the axial bore, and locks the screw, coupling element and body relative to one another.

8. The apparatus as set forth in claim 7, wherein said threading on said top end is on the

interior surface of said channel.

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9.. The apparatus as set forth in claim 8, wherein said cap portion further includes a threading and wherein said cap portion needs to be threadably advanced along the threading to be seated in the bore into its initial position.

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10. The apparatus as set forth in claim 7,

wherein said socket portion further comprises a substantially constant diameter upper section having an outwardly annular extending lip at an extreme end thereof,

wherein said opening in the bottom of the cap portion comprises an inwardly directed annular lip, and

wherein at least one of said vertical slots in the upper section of said socket portion renders the upper section thereof to be expandable and contractable such that the upper section of the socket portion may be forceably inserted into the opening in the bottom of the cap portion so that it may be retained in the interior chamber therein by mutual interference engagement of the inwardly directed annular lip of the cap portion and the outwardly extending annular lip of the socket portion.

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11. The apparatus as set forth in claim 10, wherein the interior chamber of the cap portion comprises a tapered surface such that advancement thereof into the hole causes an inwardly directed force against the upper section of the socket portion, therein causing the at least one of said vertical slots in the upper section to narrow and causes the upper section to contract and further lock the head of the screw within the interior semi-spherical volume of the socket portion.